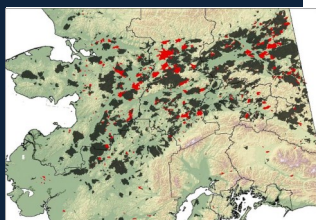




<http://akfireconsortium.uaf.edu>

Burn areas shown in red indicate perimeters that were added to the Alaska Large Fire Database. (D. Olson presentation, Oct. 2011).



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Alaska Fire Science Consortium

Workshop Summary

October 2011

Boreal Fire History Datasets in Alaska

Presenter: Diana Olson (U. Idaho)

Why? In 2005 JFSP noted a need for region-specific fire regime data compiled in a single location. This project collected existing fire history literature and tree ring datasets to provide a more complete understanding of how fire has historically impacted the boreal forest ecosystems of Alaska.

Project components:

1: Publish a literature review and synthesis of fire regimes in the Alaska boreal forest. This involved a vast literature scan and a total of 378 references were located relating to fire regimes. The result was a thorough, well organized literature review focusing largely on the fire frequency as well as ignition, seasonality, intensity, severity, etc. The publication, currently in draft form, also includes 1-2 page summaries of key Alaska fire history studies. Related studies and publications are available [online](#).

2: Create an Alaska Fire History Database utilizing fire scars and tree ages. A total of 2,786 plots and 13,585 tree ring samples were included in the comprehensive dataset used to summarize fire dates, possible fire dates and estimated tree establishment dates. The data was plotted on the [Alaska Fire and Fuels Research Map](#) and is also available on the project website in a downloadable Microsoft Access file format.

3. Improve the Alaska Large Fire Database, a database of reported fire locations and perimeters. Using various maps and imagery, fire perimeters were extended back to 1940 and points of origin to 1939. The result: An addition of 417 missing large fire perimeters; 5.8 million additional acres of burned area and additional attributes (fire name, management office, management option, lat, long, etc.).

Key Points:

- The Boreal Fire History Project [webpage](#) offers a summary of the project as well as access to:
 - Alaska Fire Effects Reference Database
 - Alaska Fire History Database
 - Alaska Fire and Fuels Research map
 - Alaska Large Fire Database
 - Draft literature review.

- The data was not originally collected with a consistent goal across collections, and collaborators welcome those interested in further analyzing data for more specific applications and to identify holes.
- JFSP [Final Report](#) (pdf), [presentation](#) (pdf) and recording ([mp4](#) or [wmv](#)).

www.frames.gov/alaska/borealfirehistory

Presenter: Jennifer Barnes (NPS)

Analysis of Six Plots Revealed:

- Strongest type conversion was in **black spruce-feather moss** areas that burned twice, both at a high severity. Areas often converted to grass/deciduous. These areas were likely more susceptible to conversion because of the lack of moisture: Dry fuels burned deeper, often down to mineral soil. In addition, the second fire burned the young spruce stand before a seed bank could be established which eliminated the seed source.

- **Black spruce-tussock** areas were a bit more resilient. After repeat fires with a moderate burn severity, these areas converted to tussock tundra.

- **Spruce-aspen** stands seemed the most resilient, with strong aspen regeneration after multiple fires in close succession.

[Presentation](#) (pdf) and [recording](#)

Shortened Fire Return Intervals in Boreal Forests

Study of multi-burn areas can offer significant insights into stand conversion and regeneration tendencies in boreal forest. In the last 50 years (1950-2010) 13% of burned area has burned more than once. National Park Service (NPS) staff visited a number of multi-burn plots from two fire areas in 2005 and 2011 to document burn severity and regeneration.

Yukon-Charley Rivers National Preserve

The 1986 Eureka Creek Fire burned 44,749 acres. The area burned again in the 2004 Edwards Creek Fire, re-burning 60% of the 1986 fire area. Both fires were moderate to high severity.

The closed black spruce plot showed a complete type conversion to deciduous forest after 2 burns, probably due to seed bank elimination after the second fire. A similar plot that burned only once (1986) reverted to shrub/herbaceous dominance 19 years post-fire.

The open Aspen-White Spruce plot burned in 1986 and 2004 featured aspen re-sprouts 7 years post-fire.

Denali National Park & Preserve

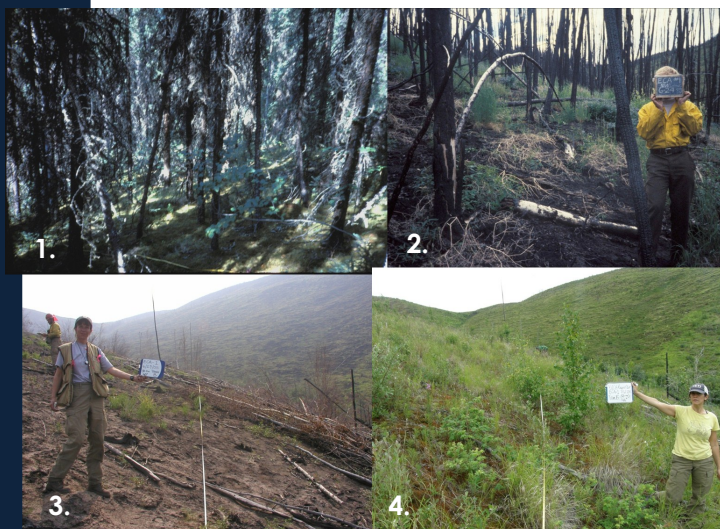
Some plots in the area burned in 1986 and 2005; others in 1990 and again in 2005. The fires were moderate to high severity.

Again, the black spruce plot, which featured shrub and herbaceous growth after the first burn, provided a great example of type conversion after the second burn. Six years post-fire, the plot was dominated by grass/herbaceous cover.

A black spruce-tussock shrub stand returned to tussock-low shrub but had no spruce seedlings six years post-fire, twice burned.

An open spruce-aspen stand suggested aspen to be the most resilient stand type: at one year post-fire twice burned the stand was mostly barren with a shallow organic layer. Five years later the plot featured strong aspen re-sprout.

Example of a black spruce stand conversion to a deciduous forest



(J. Barnes presentation, Oct. 2011.)

1). Pre-fire (1986) the plot was closed black spruce with dense feathermoss understory

2). 2 years post-fire burned once left the area with dead, charred trees and herbaceous and grass features

3). 1 year post-fire twice burned (1986 & 2004) both high severity, the plot was barren; burned all of the woody fuels on the ground leaving mostly mineral soil

4). 7 years post-fire twice burned, regenerated as grass (calamagrostis) with willows and birch.

Probabilistic Fire Analysis System (PFAS)

Presenters:
Kerry Anderson (CFS)
Dan Perrakis (FCFS, BC)

Meteorologists have been thinking in terms of scale for some time, and the concept behind this new fire growth modeling approach – Probabilistic Fire Analysis System (PFAS)—is to start thinking of fire in terms of similar scale.

Definition of scale in relation to fire growth prediction: Short-range scale looks at predicting what's happening in the next few hours; medium-range looks at 3-7 days; and long-range is a long-term – weeks to months—prediction. This system moves from having a lot of detailed information (short) to having very little specific information regarding conditions (long range).

PFAS is a long-range fire growth model based on probabilistic climatology predictions. This approach considers how big a fire might get if allowed to burn naturally for weeks or months. It becomes a balancing act between how far and fast a fire can spread vs. the likelihood a fire stopping event will interfere. The model calculates the probabilities of fire spread based on this expected balance and maps a probable fire extent map.

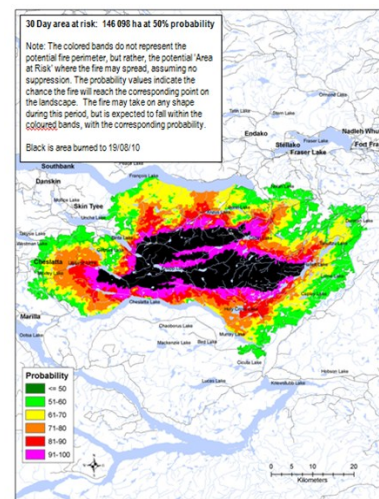
Running PFAS

In operation PFAS first utilizes GIS fuels grid data to develop a forest inventory in the relevant area. An

The second page of PFAS outputs offer probable extents maps. (D. Perrakis presentation, Oct. 2011).

algorithm transfers that inventory into one of the [16 fuel types](#) used in CFFDRS. Topographic and climate data are added; climate elements are gathered from weather stations, prioritizing stations closest to the fire area in question.

A large amount of data is produced by running PFAS, and managers sought to develop a simple product that would be most useful to its audience. The result is a two-page output including weather information, distance, probability of extinction and a fuels grid map on one page. The second page offers the probable extents map. The product is meant to be an additional tool to guide fire management decisions.



Using PFAS for Wildland Fire Decision Support

The PFAS model was used in British Columbia for 15 and 30-day predictions on 37 fires in 2009 and 10-12 fires in 2010. Comparisons with historical fires indicate the model produces realistic results, although it is difficult to validate.

- The Good: Represented fires were allowed to burn naturally with consistent, realistic results.
- The Bad: May have represented fires that were suppressed or a natural barrier/process limited their spread.
- The Ugly: No where near accurate; likely the result of poor fire information.

As forest protection agencies re-evaluate the prioritization of fire response, the use of these models can serve as an additional decision support tool.

Key Points:

- PFAS has produced reasonable results, used in collaboration with suppression officers' other assessment tools, but further evaluation will be vital to a full assessment.
- Fuel inventory is good in some cases but can be a weakness in others. CFS is always working to improve fuels data and inventories.
- Read about PFAS in the CFS [Spotlight on SCIENCE](#).
- Presentation ([part 1](#)), ([part 2](#)), and [recording](#).

Presenter: Kerry Anderson (CFS)

The [Canadian Wildland Fire Information System \(CW FIS\)](#) is a computer-based fire management information system that monitors fire danger conditions across Canada.

[Presentation](#) and [recording](#)

Canadian Wildland Fire Strategy

2.5 million ha (roughly 6 billion acres) burns annually in Canada. Strongly focused on safety and security concerns as part its organizational rubric, the Canadian Council of Forest Ministers responded to a particularly active year—2003— that burned ~300 homes, cost millions in personal property damage and \$1 billion in suppression expenses by developing the [Canadian Wildland Fire Strategy](#) (CWFS). The collaborative program coordinates efforts from provincial/territorial and national agencies to address safety as well as economic and environmental concerns regarding fire management. At the center of CWFS is the fact that fire strategy is a national concern but forests themselves fall under provincial/territorial jurisdiction. Therefore the program, which integrates six components, is an example of evolution of integrated fire management.

1. Canadian Wildland Fire Information System (CW FIS): A “Fire Data Warehouse.” A centralized data warehouse for all national fire information.

The CW FIS offers information on fire danger and behavior; fire and smoke locations; statistics; interactive weather and fuel type maps; models of fire behavior and carbon emissions; and links to provincial agencies.

2. Enhanced Canadian Forest Fire Danger Rating System: Coordinated efforts to create an enhanced and more dynamic CFFDRS, utilizing fuel, fire effects and various prediction models. Currently researchers are using LiDAR to enhance fuel-type map-

ping. Work on dynamic fuels models are using a computational fluid dynamics model (FIRETEC) to conduct virtual prescribed burn experiments to study behavior. The work is expected to provide a basis for including stand characteristics in the Fire Behaviour Prediction (FBP) system. Other elements include:

- Collaboration with Environment Canada to use lightening predictions, combined with fire occurrence prediction models, to predict fire numbers and locations as part of the CIFFC Resource Demand project.
- The new fire effects model (CanFIRE) is developing new fuel consumption and fire behavior models for the ‘Next Generation’ CFFDRS. It includes immediate site impacts and post-fire ecology response (mortality, regeneration, successional modeling).

3. An assessment of wildland fire impacts on the Canadian forest and wildland urban interface: Efforts include statistics regarding risk analysis and analyzing evacuation reports for the past three decades. Includes tracking of community evacuations, media analysis of community effects and smoke management modeling.

4. Strategic coordination of wildland fire science and management in Canada: Includes economic evaluation and development of a wildland fire science and technology initiatives. Collaborators are at the provincial/territorial, national and international levels.

Continued on pg. 5

In a Time of Change: The Art of Fire

Art and science are not often considered to be two peas in the same pod, but various programs have shown the two can relate in meaningful ways. *In A Time of Change: The Art of Fire* is one such example: It is a collaborative project with AFSC, the Fairbanks Arts Association and Bonanza Creek LTER that brings artists and fire professionals – managers and scientists—together in an attempt to reach a broad public audience by communicating through art. The fire-inspired artwork can be used to promote public understanding and awareness of fire science and management.

The approach considers the struggle scientists often experience with effective public communication while relying on the ability of artists to engage the public through aesthetics and emotion. Two events, while not funded by AFSC, are part of the broader program. *In a Time of Change: A Performance by Writers, Artists and Scientists* focused on written work, and was held in March 2008. The next event, *Focus on Future: Envisioning the Future* added performance art to the mix, featuring experimental theater, original songs and dance as well as poetry, prose, environmental essays. A visual art exhibit followed the performance, all held in September 2010.

The culminating event, which brought AFSC participants of a variety of levels into the fold, is *Art of Fire*, a multi-level effort that will include a professional art exhibit and a community art show. The entire event focuses expressly on visual art depictions of fire and enjoyed a strong response from the artistic community. The professional art exhibit received ~ 30 applications from interested artists, 9 of which were chosen to create work for the show.

Presenters:

Sarah Trainor (UAF)
Mary Beth Leigh (UAF)
Jen Northway (AFSC)
Amanda Ellis (Artist)



Photo by Sean Proctor, NPS

Organizers considered it vital to allow artists ample time—two full years—to engage with various members of the fire community and gain a broad understanding of the complex process that is fire management. Four field trips were planned to foster the opportunity for interaction between artists, scientists and members of the fire management community, offering a view of the many moving pieces of the fire science and management puzzle.

In a Time of Change: Art of Fire art exhibit will premier in Fairbanks in August 2012.

Key Points:

- The goal is to foster great science, great art and public outreach.
- The field trips led to a successful cross pollination between artists and scientists giving artists a fairly broad exposure the spectrum of fire management.
- *In a Time of Change: The Art of Fire* professional and community exhibits will open in Fairbanks in August 2012.
- [Presentation](#) and [recording](#).

www.frames.gov/afsc/artoffire

Canadian Wildland Fire Strategy (cont.)

5. Human Dimensions of Risk Mitigation at the Wildland–urban Interface: Focuses on research related to public perception of issues (risk, mitigation efforts, management options, etc.) and offers guidance to resource managers and policy makers on public response to management options and engag-

ing the public to actively mitigate wildfire risks.

6. A better understanding of the effects of Climate Change on Wildland Fire: Includes analyses of area burn projections with an eye toward regional variation.

Presenter:
Kyle Jolly (NPS)



Changes in tundra fire regime could threaten caribou livelihood. (K. Jolly presentation, Oct. 2011).

Recommendations for Fire Management Plan:

- Maintain the core winter range fire cycle (296 year cycle). This keeps 80% of core winter range more than 50 years old. Recommend a 3-year moving average to allow interannual flexibility.
- Use stand age as a simple proxy for lichen abundance.
- Focus on large continuous areas that support lichen abundance (protect large areas >30 years old).
- Establish a dedicated Galena Zone Resource advisor who can facilitate decisions on a day-to-day basis.

Impacts of a Changing Tundra Fire Regime on Caribou and Moose

The relationship between tundra fires and caribou herds involves caribou forage. Studies related to climate change related impacts to core winter habitat for caribou predict a number of threats to the ranges, especially for the Western Arctic Herd. These threats include potential increased tundra fires, encroaching moose habitat and other natural factors.

Model Predictions

- Tundra flammability may increase with more light, flashy fuels available to burn. Tundra biomass also regenerates quickly after a fire.
- Tundra fires may increase, possibly doubling in the latter half of the century; the only discrepancy is in timing and magnitude of the increases.
- Fairly modest reductions in quality habitat (tundra or spruce >50 years old) are predicted. However within

core winter range predicted fire was much more significant (3-30%). These levels could impact the herd.

- Large increases in available habitat within core winter range for moose could be expected. More moose habitat should lead to more moose, which could lead to more wolves. Higher numbers of wolf densities could increase caribou predation rates. Further, shrubs crawling up from valley areas are encroaching on lichen on ridges.

Members of the WAH Working Group, a group of local representatives from rural villages, hunters, guides, and conservationists, have called for the creation of a fire management plan for the herd. Human safety, logistical reality, moose, other forest products, other resources need to be considered along with caribou winter range.

[Presentation](#) and [recording](#)

Refining Prescriptions for Ruffed Grouse Habitat Burns

Presenter: Eric Miller (AFS)

Studies looking at the regeneration of aspen, a grouse habitat (Miller) and the relationship between flame length and char height in aspen-dominated areas (Rees) involved experimental prescribed burning. The goal was to top-kill aspen hoping to regenerate grouse habitat. Four units were burned in 2010 and 2011, and additional data from a natural burn on Moose Mountain in Fairbanks (May 20, 2011) was included to provide additional context.

Studies noted that top-kill in aspen is

a function of char height flame length, size of tree and length of season or how long it takes for tree to die. Data showed that given a char height of 100 cm, a 20 cm tree has an 8% chance of dying after the first season. Second season data showed that same char height raises the chance of dying to 58%, so it takes a few seasons for full mortality to set in. Data from some literature suggests it can take up to 5-6 years for trees to die.

[Presentation](#) and [recording](#)

State Change and Vulnerability in Alaska Boreal Forests

Presenter: A. David McGuire (UAF)

This is a new five-year project, funded out of the Department of Defense Strategic Environmental Research Development Program (SERDP). The focus of the study is on permafrost degradation, which has the potential to affect ecosystem structure and function, human infrastructure and land use.

Understanding the link between vegetation, organic soil and permafrost is vital to understanding the impact of climate change on permafrost in ecosystems that are vulnerable to abrupt disturbances (i.e. fire). This project utilized field and modeling data that effectively combined biogeochemical and landscape dynamics to help determine vulnerability to permafrost degradation on DoD lands.

Existing data shows the link between fire and organic layer. Conifer systems can maintain themselves as long as there is a thick organic layer that maintains slow decomposition, cool moist soils and slow nutrient turnover, i.e. as long as there is no fire disruption. A low severity fire isn't likely to cause disruption but a high severity fire can consume a large portion of the organic layer, providing opportunity for deciduous species to germinate and survive under conditions of warmer soils, fast decomposition and fast nutrient turnover.

This new project expands that connection, attempting to further understand the relationship between fire regime, climate, fire management and vegetation composition. It then takes the concept further to look at how that relationship affects the organic soil depth, permafrost state and vegetation composition. The project is divided into two elements: Field program and modeling.

Part 1: Develop and test ecosystem indicators of state change and collect datasets for model applications. Task 1 will monitor natural vegetation, soil and permafrost conditions in sites that experienced recent, severe wildfires. Task 2 will extend that work to include parallel measurements from managed sites with prescribed burns and fuel treatments. Task 3 will study vegetation and organic layer histories in mid-successional boreal ecosystems. The goal is to gain a

better understanding of vulnerable forest types and sites.

Part 2: The modeling component will use field information to develop projections of future landscape distribution of vegetation and per-

mafrost. These model applications, which use different scenarios for climate change, fire regime and fire management, will provide a dynamic mapping tool for land managers to determine which DoD lands are vulnerable to permafrost degradation under each scenario. These models will allow land managers to explore the consequences of interactive changes in climate and management for vegetation composition, fire dynamics and ecosystem structure and function.



Permafrost degradation has the potential to affect ecosystem structure and function. (D. McGuire presentation, Oct. 2011).

Key Points:

- The project combines field data and spatial models to predict state changes in boreal forests in response to climate change and fire management.
- Two workshops are planned to engage fire managers, offering preliminary results and gaining feedback on what types of fire management activities would be useful to include in scenarios.
- Key deliverables of the project are an interactive workbook and mapping tool designed to make no-management and management simulations easily accessible and useful to the fire managers in Interior Alaska.

[Presentation](#) and [recording](#)

Early Season Forecasting Tool for Alaska

**Presenter: Paul Duffy
(Neptune & Co.)**

Early season forecasting is one more decision making tool for fire managers. The goal is to see if it could be useful to ensure accurate resource allocation during the fire season.

The model uses in-season variables for prediction, focusing mostly on temperature and precipitation, as well as teleconnection indices from prediction centers. The aim is to use early season large scale circulation patterns that strongly influence subsequent patterns (precipitation and temperature) through the summer to predict fire.

Constructing the model utilizes dozens of potential explanatory variables. The process is run thousands of times with randomly selected data subsets to make the model as robust as possible. Multiple layers of cross-validation are necessary.

Looking at the distribution of predictions for 1950-2010, the forecast did especially well for large fire years. It always underestimates large fire years and overestimates small fire years. The next step for spatial forecast products is to build similar models with the pre-season variables. It may also be possible to use information on the spatial locations of shifts in atmospheric circulation.

Key Points:

- In terms of spatial scale, considering the entire state provided the strongest relationship between climate and fire, in part because considering a large enough area makes it is easier to ignore the ignition component.
- Statistical modeling using variables data is performed monthly March-August. Data from teleconnection indices is available at the end of each month, so monthly predictions come out the beginning of each month.
- Forecasts generated from this process reference the median of the distributions created. The median summarizes the thousands of distributions created, and is a more robust and reliable measure than the average.

http://snap.uaf.edu/fire_prediction_tool/

[Presentation](#) and [recording](#).

Fire Science Consortia National Evaluation

The Joint Fire Science Program (JFSP) wants to evaluate the consortia on a national scale, utilizing input provided via surveys from participants in the various regional groups. The survey addressed the need for changes in short, medium and long-term future planning, offering a base-line for consortia effectiveness.

There will be another online survey in the spring.

Positive Feedback:

- 58.1% agreed researchers/scientists are easy to approach.
- 51.6% agreed they draw upon fire science re-

Presenter: Sarah Trainor (UAF)

search when making work-related decisions.

- 53.3% agreed the Consortium has helped improve the accessibility of fire science information.

Room for Improvement:

- 35.3% found fire science information was available in one convenient place.

Plans are in place to offer event-specific evaluations and interviews in the future.

[Presentation](#)



Alaska Fire Science Consortium: A JFSP Knowledge Exchange Consortium

<http://akfireconsortium.uaf.edu> or www.frames.gov/afsc/2011workshop

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